Effect of Climate change and Land-use change on the structure and diversity of woody vegetation – lessons from West Africa's woodlands

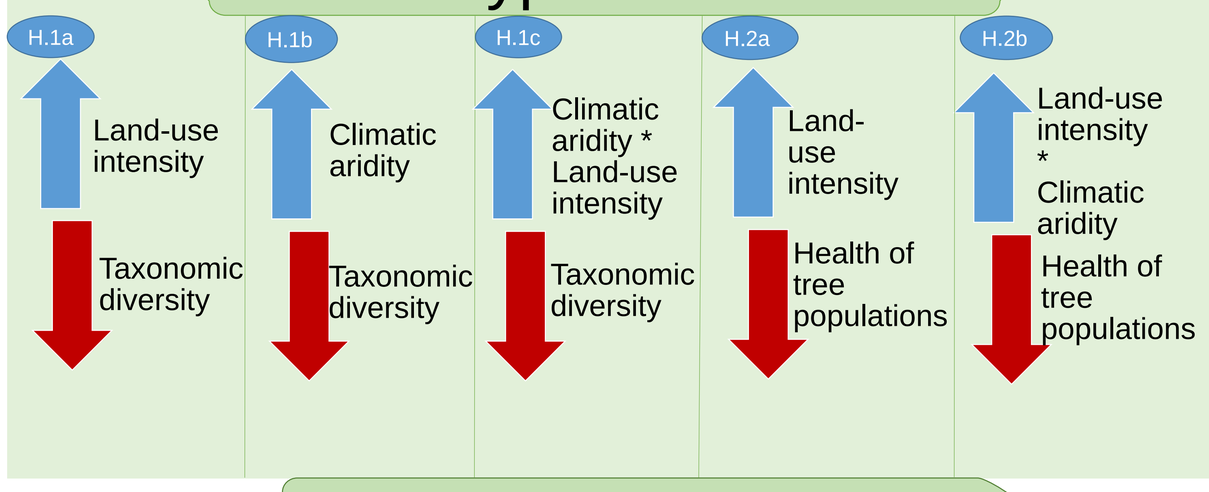
Maximus ANOCHIRIM[1,2]*, James Ofori[2], Larissa Raatz[2], Anja Linstädter[2]

1. Institute of Landscape Ecology and Nature Conservation, Universität Greifswald
2. Institute of Biochemistry and Biology, University of Potsdam, Biodiversity Research/ Systematic Botany.

Introduction

- Woodlands in West Africa provide numerous ecosystem services such as timber production and carbon storage [1].
- They are highly prone to the impact of global change (in particular, land-use intensification and climate change) [2,3].
- The interactive effect of these global change drivers on biodiversity and the health of tree populations is not fully understood.

Hypotheses



Material & Methods

1.1. Study area

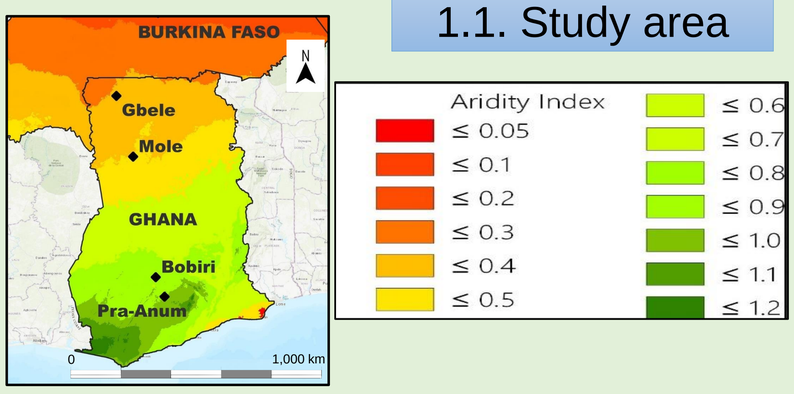


Fig. 1. Map of the study area (Ghana) showing the different study sites and their respective Aridity indexes based on FAO (1993) Aridity Index Classification.

1.2. Study design

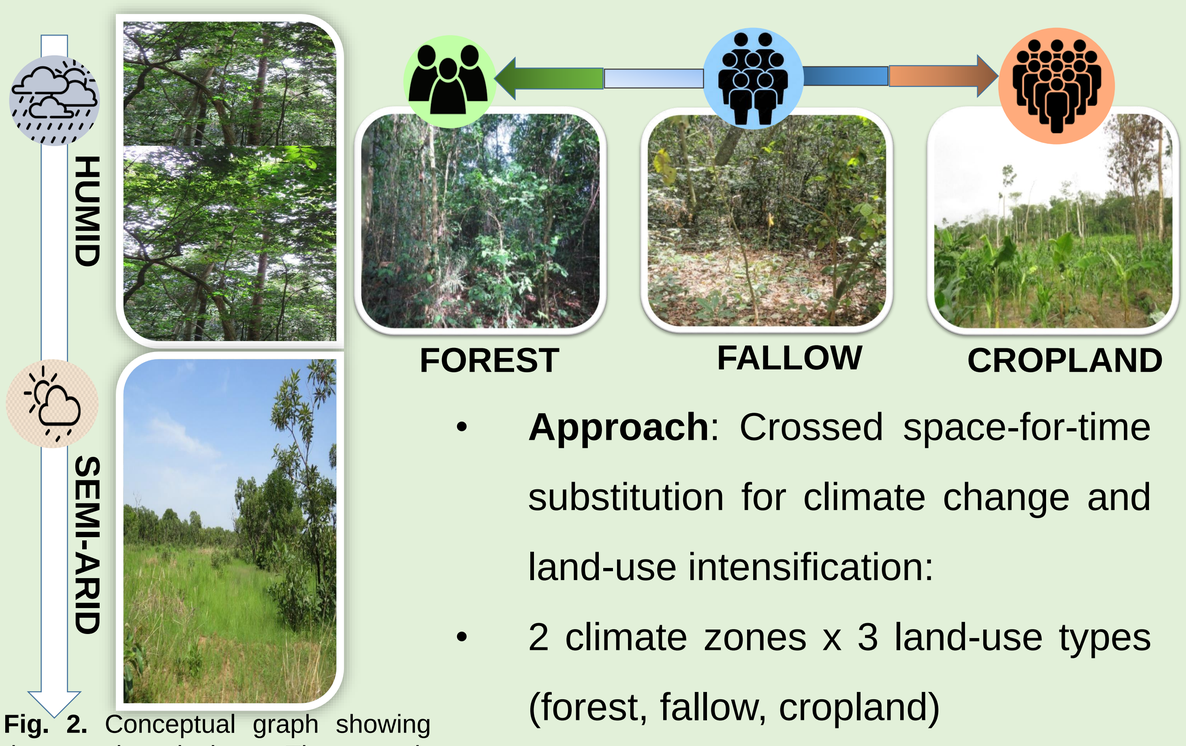


Fig. 2. Conceptual graph showing the study design. The *x-axis* represents a gradient of increasing land-use intensity while the *y-axis* represents a gradient of increasing climatic conditions (aridity index).

- **Approach**: Crossed space-for-time substitution for climate change and land-use intensification:
- 2 climate zones x 3 land-use types (forest, fallow, cropland)
- 2 study sites
- 10 plots per sites (total: 120 plots)

1.3. Plot design

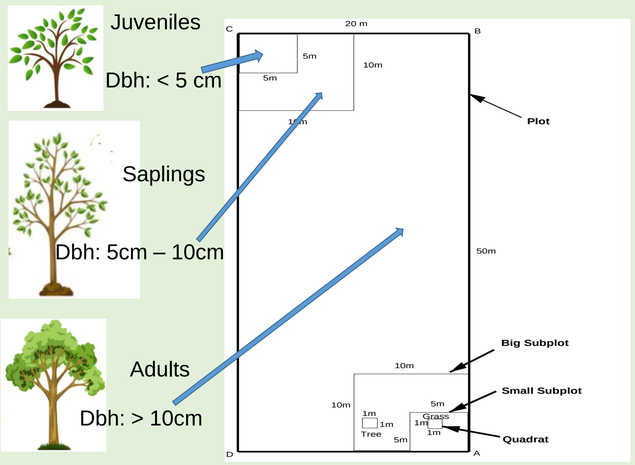


Fig. 3. Plot layout and sampling strategy for the tree inventory. In the 1000 m² plot, all individuals with a dbh >10cm are recorded; in the 100 m² subplot, all individuals with a dbh range of 5cm-10cm are recorded; in the 25 m² subplot, all individuals with a dbh <5cm are recorded.

Data collected	Parameters calculated	Level
• Dendrometric data (species identification, tree height, diameter at breast height, age class)	• Specific wood density • Aboveground biomass • Relative abundance	• Individual • Individual • Plot
• Plot data (site information, GPS coordinates)		

Fig. 4. Plot establishment and laying of transects.

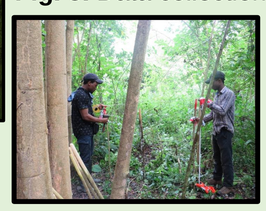
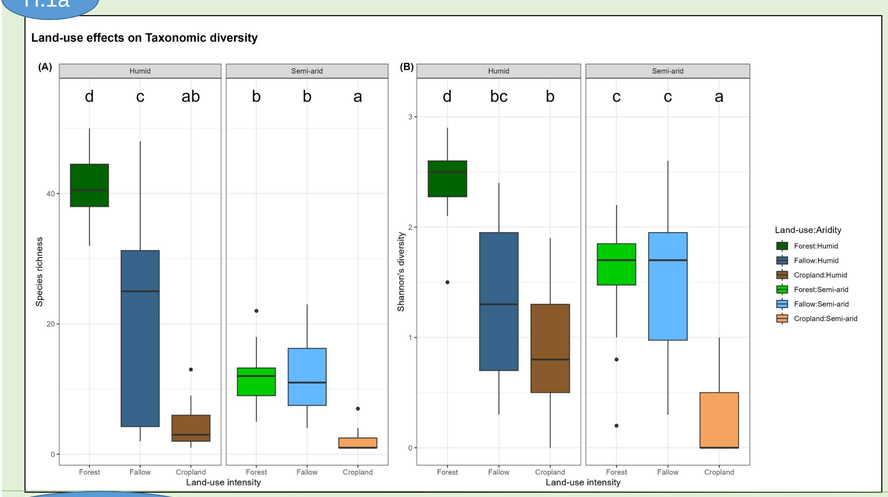


Fig. 5. Data collection

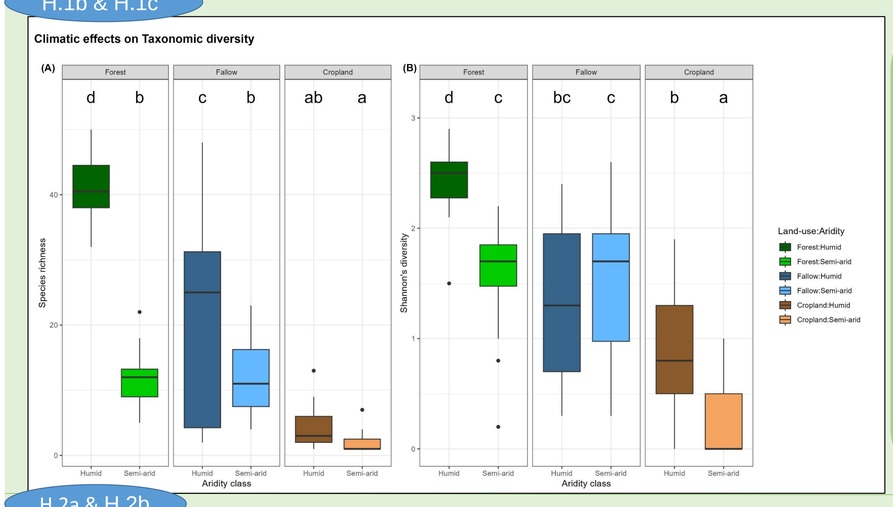
Results

H.1a



H.1a: Yes, increasing land-use intensity successively decreases taxonomic diversity. This is evident across both climate zones.

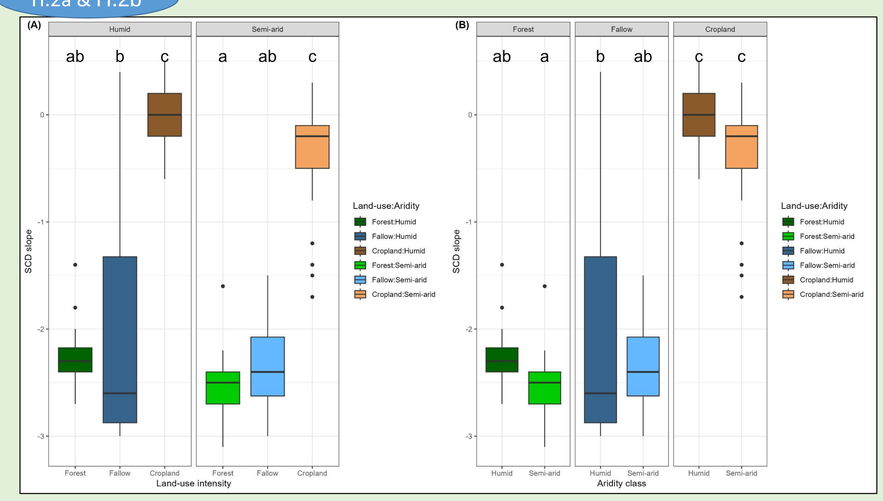
H.1b & H.1c



H.1b: Yes, taxonomic diversity decreases with increasing climatic aridity. This is especially evident in forests.

H.1c: Yes, the negative effects of increasing climatic aridity is more pronounced under intensive land-use.

H.2a & H.2b



H.2a: Yes, population health decreases with increasing land-use intensity. Croplands had flatter shaped slopes

H.2b: No, we did not observe that the negative effects of land-use intensification on stand health are more pronounced under more arid conditions!

Conclusion

- ❖ The interactive effect of land-use intensity and climatic aridity plays a very significant role in species diversity.
- ❖ Land-use has a significant effect on the health of tree populations, with more saplings and or juveniles present in the forest and fallow than in croplands.

OUR RESULTS HOWEVER, SHOWED THAT THE INTERACTION OF LAND-USE INTENSITY AND CLIMATIC ARIDITY HAS NO EFFECT ON THE HEALTH OF TREE POPULATIONS.

References

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Project GreenGaDe funded by BMBF through WASCAL